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[0001] The invention relates to a method to rebates of a number of laminar subject-matters, which single in particular follows one another, with the help of a mechanism according to the sword crease principle and an apparatus to the control of a drive of a crease sword to rebates of a number of laminar subject-matters, which single in particular follows one another.

[0002] A crease work working according to the sword crease principle exhibits two rotary moving in opposite directions arranged Falzwalzen parallel in the operation with their axes of rotation and a parallel crease sword arranged to the crease rolling gap. The crease sword is toward vertical to the plane defined by the crease rolling axles movable, the crease sword and the crease rolling gap lies in a plane, which cuts the plane bottom right angle defined by the crease rolling axles. Before the grooving the laminar subject-matter between Falzwalzen and crease sword essentially parallel, which can be folded, is to the plane defined by the crease rolling axles. By the crease sword movement vertical to the plane of the laminar subject-matter is in-struck the laminar subject-matter between the two Falzwalzen into the crease rolling gap. By frictional engagement between the laminar subject-matter and the Falzwalzen that by the nip transported becomes. From the described procedure a sharp edged crease break results. In the practice there are both pure sword folding machines, and so called combination folding machines, are provided with which additional crease works, which work according to the bag crease principle. With the bag crease works typically Parallelfalzungen become generated, while become performed with the sword crease works so called Kreuzbruchfalzungen. A bottom Kreuzbruchfalzung understands one a crease line, which runs vertical to a present parallel break crease line.

[0003] The vertical, typically linear sword movement can become different realized. A drive can become inserted, which direct or indirect of the main shaft of the folding machine becomes tapped. Alternative one can become also an independent single drive for the sword movement used. The drive system can implement thereby on several kinds the necessary movement of the crease sword: For example the sword movement can be cam controlled or however by means of a thrust crankshaft-and-connecting-rod drive realized. The typically made drive with constant driving speed, which proportional with the engine speed rises, if direct of the drive shaft transmitted. With other words in each case different crease conditions exist for various speeds. A major drawback of such drive systems is that with mechanical drive members only a general movement unitary for all laminar subject-matters of a production lot and/or. Velocity profile of the crease sword realized becomes. Simultaneous one is also the amplitude, with other words the layer of the dead points of the movement unique fixed.

[0004] A synchronization of the sword movement on the passage of the laminar subject-matters can take place clock-bound, thus in the obligation run with the clock frequency of the folding machine, or clock-unbound, with other words event-controlled.

[0005] In the EP 0,732,293 a2 a method becomes the optimization of the production management of a folding machine described, which on the known event-controlled sword crease principle based. In this case the sword drive is direct with the main drive of the first crease work, the conveyor belts, which carry the laminar subject-matters to the sword crease unit and which Falzwalzen of the sword crease work coupled. The actual sword drive consists of a crankshaft-and-connecting-rod drive, which is connected over a brake clutch combination frictional with the machine drive. The arrival of the laminar subject-matter which can be folded becomes detected over a sensor. In order to release the sword stroke, a brake dissolved and the clutch is switched on. The crease sword becomes stopped in the top dead center, i.e. the brake is switched on and the clutch is switched off, after a signal of the sword drive became obtained.

[0006] The determination of the point of time lag can take place for example on the subsequent paths: In the DE 33 25 139 disclosed becomes, as a crease sword price increase becomes in such a manner performed that the laminar subject-matter straight is hit to the time into the pair of crease rollings, if its leading edge has the stop in the crease work achieved. A detector element or a sensor corresponding distance up to the notice in the crease work set becomes on one the length of the laminar subject-matter. By means of the detection of the rear edge of the laminar subject-matter which can be folded, which ran into the crease work, the crease sword stroke becomes triggered and again stopped in the top dead center.

[0007] Other state of the art forms the EP 0,987,210 a2. In this document a crease sword drive becomes disclosed, which covers a pneumatic stroke drive. In order to prevent with a malfunction of the crease sword drive a larger committee, detecting means are provided for at least two positions of the crease sword, which deliver a reaching of the corresponding in each case position of the crease sword in each case to control means. The control means are so formed that it switches the folding machine off, if first or the second signal will not deliver particular time before to one.

[0008] The other a folding machine becomes disclosed in the EP 0,522,408 A1, which at least one sword crease work

and an investor exhibits and which by it is characterised that the drive of the folding machine exhibits a single drive for the sword crease work and the investor, which by means of a programmable controller coordinated becomes.

▲ top [0009] The fact that the phase position strews for the machine clock of everyone the single current, laminar which can be folded subject matters in a sequence around a middle phase position, thus that exhibits the periodic sequence of the laminar subject-matters small disturbances transported by the machine, has with other reasons to the fact guided that the event-controlled drive is preferred to the clock-bound crease sword drive. Adverse one is with the fact however that by the high clock sequences present high-speed machines a relative large wear of the mechanical components arises by the high positive and negative accelerations. An other serious disadvantage is the wear of the friction linings of clutch and brake, which dependent by the service life clearance must be exhibited and placed behind.

[0010] From the DE 198 43 8/2 A1 for example is known that a crease sword drive can become realized by a linear motor. The other shown, like a control and a control in response of material parameters, is like thickness, bending stiffness and other one in this disclosure, which subject-matters and of machine parameters, like the angular velocity of the Falzwalzen, which can be folded, which can become speed of the crease sword and different one, realized. It will measurement values received and evaluated, in order to produce and realize material and speed-dependent crease sword expensive curves, which ensure an high crease quality and put aside manual adjustments at the crease measurer. While can become adapted thereby the crease procedure actual for the bottom crease sword a located sheet individual designed and to the subject-matter which can be folded, the question remains open, to which time the movement of the crease sword triggered and/or. itself the periodic repeating movement of the crease sword of the home position started will must.

[0011] The instant invention is the basis the object to suggest a method to rebates of a number of laminar subject-matters and a mechanism to the control of a drive of a crease measurer which exhibit a reduced wear in the operation and an high precision with larger clock frequencies, with which the folding machines operated becomes, possible.

[0012] This object becomes by the method with the features according to claim 1 and the mechanism with the features according to claim 10 dissolved

[0013] The solution of the combined advantages of the clock controlled and the event-controlled drive of the crease sword. By the use of controllable single drives, for example of linear drives, pneumatic servo axles, hydraulic servo axles or such a thing, it is possible to realize by corresponding default, desired individual shapable movements of the crease sword. Thus a direct at the parameters of the production lot, in particular the machine, process and material parameter, adapted velocity profile of the crease sword can be gone through. An other advantage arises in the case of use of a linear drive, for example from vertical adjustment or in the case of use of a crankshaft-and-connecting-rod drive as a result of variation of the radius that it is just as possible to change the distance between the two turning points or dead points of the movement so that the distance of the crease sword in its extreme position in the vicinity can become the Falzwalzen in such a manner selected that the laminar subject-matters, which single in particular follows one another become precise guided between the Falzwalzen, without the crease sword is worn between the Falzwalzen drawn and thus in lapses of time. During a such sword price increase by a controllable single drive the laminar subject-matter is hit to the appropriate time so rapid that the laminar subject-matter with smallest distance, subsequent on it, can run into the crease work. Via the individual default of velocity profiles it is not possible to let the movement if possible continuous take place with other words the clutch brake combination must continuous started and be stopped. Thus the wear of the mechanical structural elements becomes significant reduced.

[0014] Favourable way exhibits the velocity profile of the crease sword of at least two portions: to the already described cyclic, essentially periodic portion, which is typically anharmonisch, and on the other hand an other portion, that it possible to consider the event of the individual straight laminar subject matter incoming into the crease work. A anharmonische movement, which is in a pre and a retreat of the sword divided, is particularly favourable. With other words, it becomes an advantage with a first certain movement and a retreat with a second movement, which at least slight differs from the first certain movement of the advantage, performed As already mentions, the phase position of single laminar subject-matters strews around a central phase position to the machine clock. The presence of the laminar subject-matter at a location with known distance before the crease work, which the laminar subject-matters before arrival at the crease work go through, becomes according to invention found. With the knowledge of the speed, it is by at least partial calculation from machine, process and material parameters or by individual measurement, can the arrival time of the laminar subject-matter the bottom crease sword be precalculated, so that the point of time lag for the velocity profile of the crease sword, which either from known velocity profiles selected or but for the current procedure calculated becomes, can become certain. For example can from the removal of the laminar subject-matter and its speed on first, early stage for mechanism to rebates, for example to a front notice, which are precalculated arrival time at a second, late time of the laminar subject-matter with known acceleration of the subject-matter on the path for mechanism to rebates The velocity profile is generally dependent of various machine parameters. In particular the parameters cover aspects of the sucking act price increase, which depends on the sword drive. According to invention thus the necessary velocity profile for a certain laminar subject-matter the bottom crease sword is a superposition from a cyclic portion and at least an other portion, which are adapted to the individual laminar subject-matter. It, if the time course is free of intervals, is particularly favourable on which the velocity profile complete zero is. For expert is clear that an avoidance of times, at which the velocity profile is zero, due to which reversal possible is not, since the first derivative in the extreme values of the associated local profile disappears. A bottom interval of the time course of the velocity profile, on which the velocity profile is complete zero, thus a portion of the velocity profile with dimension 1 is to be understood, which is a selected with intention.

[0015] An other advantage of the invention process and the mechanism according to invention is that the cyclic movement is according to invention independent of the required cyclic movements, within the crease work, in other crease works of the machine, since the cyclic movement of the crease sword in the crease work according to invention becomes simultaneous individual designed on the clock frequency of the laminar subject-matters incoming into this crease work, which single in particular follows one another, on the average predetermined and, so that scatterings around a middle phase position considered to become to be able. With other words, the invention process and the mechanism according to invention unite the advantages of a clock-bound with a event bound control.

[0016] An other advantage of the mechanism according to invention consists of the fact that the individual shapable minimum distance between crease sword in the turning point and Falzwalzen can become in particular the length and/or width and/or thickness of the laminar subject-matter adapted. Beyond that a higher production achievement can become achieved by different rapid pre and retreat of the sword with short and wide sheets. The other a dead time compensation can, i.e. become a compensation of that time, which passes between the signalling to the start of the movement and the actual start of the movement, performed. The dead time exhibits bottom different the components of the switching time of the drive unit and the slip time of the crease sword.

[0017] In a favourable development of the invention by an additional detector at the rear edge of the laminar subject-matter a possible grooving detects the released movement of the crease sword can in this case by direction of rotation reversal and/or by deceleration of the movement retrogressive made become, by going through, special velocity profile. Advantageous manner switches itself off the machine, in order to avoid an undesirable stopping at not accessible location of the machine, and so that the folded laminar subject-matter direct remote can become.

[0018] Other advantages and favourable development of the invention become shown on the basis the subsequent fig and their description.

[0019] It shows in detail:

Fig. 1 Scheme of the topology of the mechanism according to invention to the control of a drive of a crease sword to rebates of a number of laminar subject matters,

[0020] The Fig. 1 shows the schematic structure and the topological connection of the single units, which the mechanism according to invention covers to the control of a drive o' a crease sword and which execution of the invention process permitted On the transport means 10 at least a lam nar subject matter 12, which exhibits a speed V, in transport direction A is advanced to the mechanism according to invention. It passed thereby the position of a detector 14 in known distance D to a point of the mechanism to rebates, for example to the front notice 36, after which sword crease principle, which by the presence of the subject-matter at least a signal generated, which becomes 18 transmitted over a connection the exchange of data and/or control s gnals 16 the computing unit. Between crease sword 34 and detector 14 in known distance D can be appropriate for st ll other assemblies if necessary.

[0021] To the prediction of the time of the arrival of the laminar subject-matter 12 at the mechanism to rebates according to the sword crease principle also the speed V at the location with known distance D and the speed between the location must be in distance D and the mechanism to rebates, thus the acceleration of the laminar subject-matter on the path of the location with distance D for mechanism to rebates, known beside the knowledge of the distance D to a point of the mechanism to rebates, for example to the front notice 36 The speed V can become according to invention thereby either from the knowledge of mach ne parameters, like clock frequency, throughput or such a thing, derived or calculated, or the speed V can become at the location with known distance D measured. Favourable-prove at least the two subsequent methods are offered on: On the one hand a detection of the presence of two points with known distance, for example front and rear edge, the laminar subject-matter can become 12 performed and the times of both events of the presence certain with the help of the detector 14. The speed V calculated then known-measured from the difference quotient. On the other hand the mechanism in a favourable development of the invention cannot exhibit at least an other detector with likewise known, necessarily same distance D as the detector 14 for mechanism to rebates, so that from the passage of the same point, for example the front or the rear edge, the laminar subject-matter 12 various times the speed with the help of the difference quotient calculated can become.

[0022] From the knowledge of the speed V of the laminar subject-matter 12 and the distance D between the position of the detector 14 and the front notice 36 the time of the arrival of the laminar subject-matter 12 at the mechanism can become rebates and thus the point of time lag of the crease sword movement calculated in the computing unit. Correction values, how they are for example due to a transportation slip or such required, can find consideration. With other words, the major influences on the movement of the laminar subject-matter 12 are essentially known, so that with the initial conditions distance D and speed V with essentially known movement law can become the velocity profile of the laminar subject matter 12 with sufficient precision between the location with known distance D and the mechanism rebates the certain Thus the time of the arrival of the lam nar subject-matter 12 at the mechanism can be precalculated to rebates according to the sword crease principle, so that a determination of the time of releasing the movement of the crease sword becomes possible Simultaneous one becomes few velocity profile for the crease sword 34 either calculated or but from deposited velocity profiles selected, which favourable-proves 22, which exhibits a connection to the exchanging data 20 to the computing unit 18, in a data storage unit is deposited. In particular the switching time of the computing unit 18 and the slip time of the crease sword 34 are also included into the calculation. Beyond that also a calculation of the distance between the two turning points, dead points, the movement and the length of the minimum distance of the crease sword becomes 34 the Falzwalzen 38 made beside the calculation of the necessary velocity profile of the crease sword 34. The movement of the crease sword 34 becomes triggered, and the crease sword 34 becomes driven with the certain velocity profile.

[0023] In a favourable development of the invention the computing unit 18 exhibits a connection to the exchange of data and/or control signals 24 to a man-machine interface 26, which typically a display and an input unit cover. The machine operator can put thereby relevant data informations, as for example machine, process, material or correction parameters and such a thing, to the direct task at the disposal. Over the connection to the exchange of data and/or control signals 28 is the computing unit 18 with the drive unit 30 of the crease sword connected.

[0024] Between the drive unit 30 and the actual crease sword 34 ex sts an active compound 32, which various developments, as, can have gears, bars and such a thing. A typical sword drive with servomotor exhibits either a thrust crankshaft-and-connecting-rod drive or a gear wheel rack combination. The crease sword 34 implements a cyclic linear movement, whose direction is designated by B. By means of the crease sword 34 the laminar subject-matter becomes 12, if it arrived at the front notice 36, pressed in essentially perpendicular direction the transport direction on the nip between the Falzwalzen, whose one, 38, is more visible in this view and their other hidden lies behind it in the paper-planar

[0025] In an other favourable development the invention exhibits a rear edge detector 40, with whose assistance found can become whether it concerns with the laminar subject-matter crease width unit a product. This detector 40 is 18 linked with a connection to the exchanging data 42 with the computing unit, so that with entry of a corresponding event the drive unit can become 30 of the crease sword when desired 34 stopped moved with another velocity profile or.

[0026] In an alternative embodiment of the invention at least a signal, for example with arrival of the leading edge of the laminar subject-matter 12, becomes generated the determination of the time of the arrival of the laminar subject-matter 12 at the mechanism rebates at the rear edge detector 40, which becomes 18 transmitted over the connection the exchange of data and/or control signals 42 the computing unit.

[0027] From the knowledge of the speed V, the which analogue described above can take place, and the distance E between rear edge detector 40 and front notice 36 then the time of releasing the movement of the crease sword can become 34 certain after the invention process

[0028] In another favourable development of the invention a connection exists 44 to the actual machine control 46 of the crease work or the folding machine to the exchange of data and/or control signals

[0029] A such mechanism according to invention can become in a single crease work or in folding machines a realized.

REFERENCE SYMBOL LIST

10 Transport means
12 laminar subject-matter
14 Detector
16 Connection to the exchange of data and/or control signals
18 Computing unit
20 Connection to the exchanging data
22 Data storage unit
24 Connection to the exchange of data and/or control signals
26 Man-machine interface
28 Connection to the exchange of data and/or control signals
30 Drive unit
32 Active compound
34 Crease sword
36 Front notice
38 Falzwalze
40 Rear edge detector
42 Connection to the exchange of data and/or control signals
44 Connection to the exchange of data and/or control signals
46 Machine control.

A Transport direction
B Direction of movement of the crease sword
D Distance between detector and front notice
E Distance between rear edge detector and front notice
V Speed of the laminar subject matter